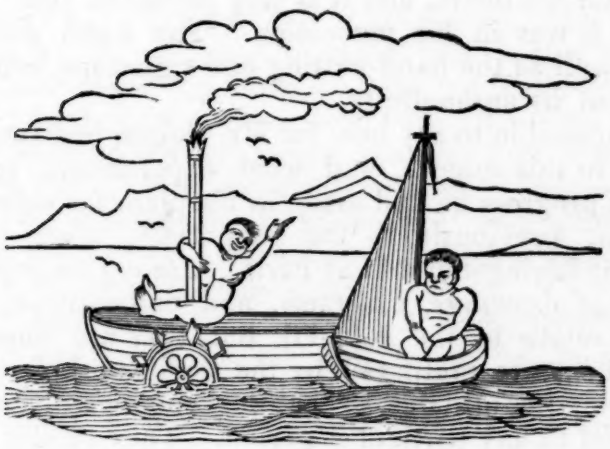
The Mechanic.

MAY, 1834.

[Compiled for the Mechanic.]

ROBERT FULTON.

[Continued.]



We must now revert to an early period of Mr. Fulton's life, to trace from the beginning the progress of that great improvement in the arts, for which we, and all the world, are so much indebted to him: we mean the practical establishment of navigation by steam.

At what time his attention was first directed to this subject, we do not know; but it is ascertained that, in the year 1793, he had matured a plan, in which, even at that early day, he had great confidence. The evidence of this is his letter to the Earl of Stanhope, to which we have before adverted. This letter is dated the 13th of September, 1793. The answer from Lord Stanhope is dated the

7th of the following October, at Holdsworthy, in Devon; and is as follows :—' Sir, I have received your's of the 13th of September, in which you propose to communicate to me the principles of an invention, which you say you have discovered, respecting the moving of ships by the means of steam. It is a subject on which I have made important discoveries. I shall be glad to receive the communication which you intend, as I have made the principles of mechanics my particular study,' &c.

We have been thus particular in noticing this letter from Lord Stanhope, because it is a document which precludes all controversy as to Mr. Fulton's having turned his attention to steam-boats previously to its date; a fact which could not have been disputed, as it has been, if Mr. Fulton, at the time when it so much concerned his interest, could have laid his hands upon the letter of Lord Stanhope, which has fortunately survived the shipwreck that has been mentioned. It was accidentally found in a mass of mutilated papers after his death, and it is very probable that he did not know it was in his possession. The frank and post-mark, as well as the hand-writing and signature, can leave no doubt of its authenticity.

It is impossible to say how far Mr. Fulton had turned his attention to this subject, and what experiments, or what degree of progress he had made in his plans for steam-boat navigation, previously to the year 1801, when he and Chancellor Livingston met at Paris. Among his papers are a variety of drawings, diagrams, and calculations, which evidently relate to the subject, but they are imperfect; most of them are mutilated by the accident before mentioned, and without dates, so that they cannot with certainty be assigned to any particular period. They render it very evident, however, that paddle-wheels, as they are now used in the boats which he built, were among his first conceptions of the means by which steam-vessels might be propelled.

The history of the discovery of the power of steam, and of its application to engines which have been made for its use, and the progress of their improvement, previous to the time of its being used as a moving power in aid of navigation, will be found in the Mechanic, at pages 21, 37 and 73.

Our limits will not permit us to examine minutely, the pretentions of those who claim to have preceded Mr.

Fulton in the application of steam to navigation. That it was not successfully accomplished by any one prior to the execution of his plan, seems to be proved by the acknowledged fact, that though in several instances boats had been made to move by the force of steam, yet not one, either in Europe or America, had ever answered any other purpose than to prove an unsuccessful experiment. If steam-boats had ever before been constructed so near perfection as to show that they might be used with their present advantage, can it be believed that they would have been subsequently abandoned? It is as reasonable to suppose that a man would live in want, if he possessed the power of transmuting metals.

It is very true, that some ingenious attempts to propel boats by steam had been made long before Mr. Fulton thought of it. Indeed, it is natural to suppose, that the possibility of applying this power to so desirable an object as navigation, would be one of the first thoughts that would occur, when it was seen that it might be made to move machinery. Accordingly, from that time to this, there have been many projectors, some of them ingenious and respectable; but in none of those who have attempted this great object, were united those rare qualities and acquirements to which Mr. Fulton owed his success. That is to say, a genius for invention, mathematical and philosophical science, mechanical knowledge, and what is rare in combination with these, considerable practice.

Mr. Fulton, when he conceived a mechanical invention, not only perceived the effect it would produce, but he could ascertain, by calculation, the power his combination would afford, how far it would be adequate to his purpose, and what would be the requisite strength of every part of the machine: and though his numerical calculations did not always prove exact, and required to be corrected by experiments, yet they assured him of general results.

None of the projectors prior to him, whose claims have been set up to rival his, have left any traces of calculations, or even any account of the principles upon which their machines were contrived. They were among the multitude who thought that steam might be applied to navigation. They set to work to form a machine, upon a crude notion, that it might be made to do something, without having attempted to calculate what, and without having any precise plan for its execution. When it did not answer

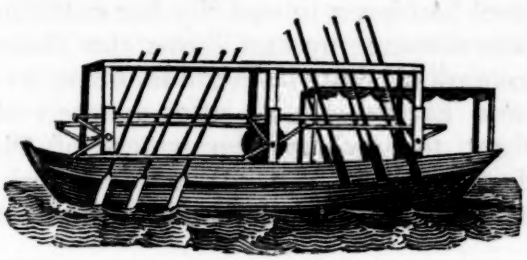
their expectations, it was abandoned, because they could not perceive the cause of its failure, or any mode of making improvements upon it. On the contrary, Fulton never attempted to put in practice any improvements in mechanics, without having made his calculations, drawn his plans, and executed his models. A view of the progress of his improvements, as they are to be traced from the calculations, drawings, and notes on experiments, which he has left, would afford the most uesful lessons; and a work which would give them to the world in a proper manner, would be invaluable. It would show that many of the contrivances for which claims have been made, as for new inventions, because they differ from what he used, occurred to him, and were rejected after consideration and experiment, because he found them inferior to those he finally adopted.

It is remarkable, that the persons who have been most disposed to question the claim of Mr. Fulton, as the first who brought navigation by steam to be practically useful, are precisely those who have been utterly unsuccessful in their own attempts; and it would seem that, exactly in proportion as their efforts were abortive, and as they had thrown away money in fruitless experiments, their claims rose in their own estimation, and that of their partisans. The pretensions of the constructors of steam-boats which could be of no use, and which, on that account, were abandoned, have been considered by some, as equal at least, if not superior, to the merits of the man who attained the most complete success.

It was not merely the claims of individuals which were founded on this basis; nations, ambitious of the honor of an improvement so beneficial to mankind, made pretensions, on no other foundation. The French contend that the Abbé Arnald, in the year 1781, proposed to apply the power of a steam-engine on board a vessel; the English found their claim on a variety of abortive experiments; but we may judge of the whole, by the account we have of the last which were made, prior to Mr. Fulton's exhibition on the Seine. We are told, that about the year 1800, Messrs. Hunter and Dickinson took out a patent in England, for propelling vessels by steam. A trial was made on the Thames, in January, 1801. And though these gentlemen, it is to be presumed, had the advantage of knowing what had been previously attempted in England, by the Earl of Stanhope, by Mr. Thompson, and by Mr. Walker; yet it is

mentioned in the Monthly Magazine, which gives an account of this performance, as very creditable to them, and as exceeding everything before accomplished, that the vessel was moved at the rate of three miles an hour through the water. The Scotch found a claim on an experiment which was made in that country about the same time. A steamboat was there constructed, which, it is said, drew three vessels of sixty or seventy tons burden each, at the rate of two and a half miles an hour, on the Forth and Clyde Canal. We extract the following from a report of the Commissioners of the Forth and Clyde Canal, made at a general meeting of the Proprietors, held in London, on the 4th of May, 1831. 'So long ago as the year 1802, a trial was made, by the direction of the late Lord Dundas, of a steam-boat for dragging other vessels along the canal. This was the first public trial of steam for a useful purpose in navigation. In consequence of the imperfect success of this trial, but chiefly in consequence of the pre-conceived opinion of all the directors and officers of canals, that the action of steam-paddles would be destructive to canal banks, the further prosecution of this measure was dropped, and steam navigation, in place of being first introduced into actual practice in Great Britain, was established first in America.'

No attempt that deserves notice, has ever been made in our own country upon which any claim, adverse to Mr. Fulton's, has been pretended, except one, of which a Mr. Fitch, a very ingenious mechanic, was the projector, and which was made on the Deleware, in the year 1783, subsequently, it will be observed, to the experiment of the Abbé Arnuld; so that if Mr. Fulton is not entitled to be considered as the inventor of the steamboat navigation, because he was not the first to think of it, for the same reason, Mr. Fitch cannot have that merit. Mr. Fitch's boat was propelled by paddles, and not by wheels, as will be seen by the following engraving, and his own description, extracted from the Columbian Magazine, for December 1786.



'It is to be propelled through the water by the force of steam. The steam-engine is to be similar to the late improved steam-engines in Europe, these alterations excepted: the cylinder is to be horizontal, and the steam to work with equal force at each end thereof. The mode of forming a vacuum is believed to be entirely new; also of letting the water into it, and throwing it off against the atmosphere, without any friction. The undertakers are also of opinion that their engine will work with an equal force to those lately improved engines, it being a twelve-inch cylinder; and they expect it will move with a clear force, after deducting the friction, of between eleven and twelve hundred pounds weight, which force is to be applied to the turning of an axle-tree on a wheel of 18 inches diameter. The piston is to move about three feet; and each vibration of the piston turns the axle-tree about two-thirds round. They propose to make the piston to strike thirty strokes in a minute, which will give the axle-tree about 40 revolutions. Each revolution of the axle-tree moves twelve oars five and a half feet: as six oars come out of the water, six more enter the water, which make a stroke of about eleven feet each revolution. The oars work perpendicularly, and make a stroke similar to the paddle of a canoe. The cranks of the axle-tree act upon the oars about one-third of their length from their lower end, on which part of the oar, the whole force of the axle-tree is applied. The engine is placed in about the thirds of the boat, and both the action and re-action of the piston operate to turn the axle-tree the same way.'

Mr. Fitch was supported by an association of wealthy men, who themselves witnessed the performance of his boat, who had advanced large sums of money, which were expended upon her, and the reimbursement of which depended on her successful operation. There was, at least, one of this association, who would not be pleased to be considered in any but the first rank of mechanicians; yet this vessel and the project were entirely laid aside, after the vessel had been moved by her machinery several times for some distance up and down the Delaware river. It must be remarked, that this abandonment was made by Mr. Fitch and his associates, after he had obtained an exclusive right to navigate the waters of the states of Pennsylvania, New York, &c. Was this experiment of Mr. Fitch and his associates, or were any of the British experi-

ments, successful? If they were, how came they to be abandoned? How comes it that for many years they were not thought of, and that the memory of them was not revived, until after Mr. Fulton's boats were seen in successful operation?

Mr. James Rumsey, an extremely ingenious American, who knew well all that Fitch had done, and had been engaged in a controversy with him in this country relative to the boat built on the Deleware, some time after Mr. Fitch had relinquished or abandoned his project, went to London, and with the pecuniary aid of a wealthy American, and several monied men, he built a steam-boat on the Thames. She was to be propelled by an engine, working a vertical pump in the middle of the vessel, by which the water was to be drawn in at the bow, and to be expelled at the stern, through a horizontal trunk in her bottom. But this boat was, in her turn, abandoned without ever having been in successful operation. Can it be believed, that if Mr. Fitch's boat had performed to any useful purpose, Mr. Rumsey would have so entirely failed? or, if he had seen the successful operation on the Delaware, of such water wheels as are used on the Fulton boats, would he afterwards have resorted to the unpromising means of propelling his boat, which he adopted?

But, perhaps, the most satisfactory evidence of the success which attended these attempts, will be found in a communication of a gentleman of science, who had the best opportunities of knowing what had been done in America on this subject, and who was called upon for information in relation to it, at a time when neither interest, jealousy, nor controversy, could have created prejudice or bias.

A society in Rotterdam had applied to the American Philosophical Society, to be informed whether any, and what improvements had been made in the construction of steam-engines in America. The subject was referred to Mr. Benjamin H. Latrobe, who, on the 20th of May, 1803, read to the Philadelphia Society a report, from which, as it is recorded in their Transactions, the following are extracts. 'During the general lassitude of mechanical exertion, which succeeded the American revolution, the utility of steam-engines appears to have been forgotten; but the subject afterwards started into very general notice, in a form in which it could not possibly be attended with

much success. A sort of mania began to prevail, which indeed has not yet entirely subsided, for impelling boats by steam-engines. Dr. Franklin proposed to force forward the boat by the immediate action of the steam upon the water. Many attempts to simplify the working of the engine, and more to employ a means of dispensing with the beam, in converting the libratory into a rotary motion, were made. For a short time, a passage-boat, rowed by a steam-engine, was established between Bordentown and Philadelphia, but it was soon laid aside.' After naming other experiments, he says :—' Nothing in the success of any of these experiments appeared to be sufficient compensation for the expense, and the extreme inconvenience of the steam-engine in the vessel.' After pointing out a number of objections to the use of the steam-engine for impelling boats, from which, he says, no particular mode of application can be free, he has the following :—' Nor have I ever heard of an instance, verified by other testimony than that of the inventor, of a speedy and agreeable voyage having been performed in a steamboat of any construction.'

After this testimony, it is impossible now to make it be believed, that either Fitch or Rumsey constructed a steamboat which was capable of being advantageously used, and that they abandoned their projects after they had been accomplished, for want of patronage, or pecuniary assistance. Mr. Fitch and Mr. Rumsey were unquestionably very ingenious and enterprising mechanicians: they saw, as thousands of others have seen, since the power of steam has been known, that it might be applied to navigation; but they did not know how to make the application. Like many other projectors who have followed them, they wanted that rare union of genius and science, with *practical knowledge*, which Mr. Fulton so happily possessed. It is to this uncommon union, we repeat, of capacities to invent, to calculate, and to execute, that Mr. Fulton owed his success; and those who attempted similar projects, without possessing the same qualities, might have exhausted their lives and fortunes, and not have accomplished their wishes. So great a triumph of the arts as steam-boat navigation, could never have been attained till some Fulton appeared to achieve it.

In speaking of what had been done in this country prior to the running of Mr. Fulton's boats, it would be great injustice not to notice, with due respect and commendation,

the enterprizes of the late Chancellor Livingston, who had so intimate a connection with him in the progress and establishment of this great public benefit. While Mr. Livingston devoted much of his own time and talents to the advancement of science, and the promotion of the public good, he was fond of fostering the discoveries of others. The resources of his ample fortune were afforded with great liberality, whenever he could apply them to the support and encouragement of genius. He entertained very clear conceptions of what would be the great advantages of steam-boats, on the large and extensive rivers of the United States. He had applied himself with uncommon perseverance, and at great expense, to constructing vessels and machinery for that kind of navigation. As early as 1798, he believed that he had accomplished his object, and represented to the legislature of New York, that he was possessed of a mode of applying the steam-engine to propel a boat on new and advantageous principles; but that he was deterred from carrying it into effect, by the uncertainty and hazard of a very expensive experiment, unless he could be assured of an exclusive advantage from it, should it be found successful.

The legislature, in March, 1798, passed an act, vesting Mr. Livingston with the exclusive right and privilege of navigating all kinds of boats, which might be propelled by the force of fire or steam, on all the waters within the territory or jurisdiction of the state of New York, for the term of twenty years from the passing of the act; upon condition that he should, within a twelvemonth, build such a boat, the mean of whose progress should not be less than four miles an hour.

Mr. Livingston, immediately after the passing of this act, built a boat of about thirty tons burden, which was propelled by steam; but as she was incompetent to fulfil the condition of the law, she was abandoned, and he, for the time, relinquished the project.

Though Mr. Livingston, previously to his connection with Mr. Fulton, had done more than any other person towards establishing steam-boats, and though his experiments had been more expensive, and more successful, than any we have heard of, yet he was not among those who founded, on their fruitless attempts, a claim to be the inventors of navigation by steam. On the contrary, Mr. Livingston availed himself of every opportunity of acknowl-

edging Mr. Fulton's merits; and when he was convinced that Mr. Fulton's experiments had evinced the justness of his principles, they entered into a contract, by which it was, among other things, agreed, that a patent should be taken out in the United States in Mr. Fulton's name, which Mr. Livingston well knew could not be done without Mr. Fulton's taking an oath that the improvement was solely his.

We have seen that Mr. Fulton's mind, previous to his return to this country, had long been directed to the project of propelling boats by steam. We know that prior to 1793, he had exercised his thoughts on this subject. We see by his letter to Lord Stanhope of that date, that he had then matured a plan, of which he speaks with confidence, that it would be successful. Upon Chancellor Livingston's arrival in France, he was induced to revive his thoughts of this invention, by Mr. Livingston's representations of the incalculable advantages which would be derived from navigation by steam in this country, by his account of the approaches to success which he had made in his experiments, and by the pecuniary support which the Chancellor's wealth enabled him to offer. Mr. Fulton began a course of calculations upon the resistance of water, the necessary force to move a body through it, upon the most advantageous form of the body to be moved, and upon the different means of propelling vessels which had been previously attempted; and after a variety of calculations, he rejected the plan proposed of using paddles or oars, likewise that of duck's feet, which open as they are pushed out, and shut as they are drawn in, and also, that of forcing water out at the stern of the vessel; retaining two methods only, as worthy of experiment, namely, endless chains with resisting boards upon them, and the paddle wheel. The latter was found to be the most promising, and finally adopted, after a number of trials with his models, on a little rivulet which runs through the village of Plombieres, to which place he had retired to pursue his experiments without interruption. This was in the spring of 1802.

It was now determined to build an experimental boat, which was completed in the spring of 1803; but when Mr. Fulton was on the point of making an experiment with her, an accident happened to the boat, the wood-work not having been framed strong enough to bear the weight of the machinery, and the agitation of the river. The acci-

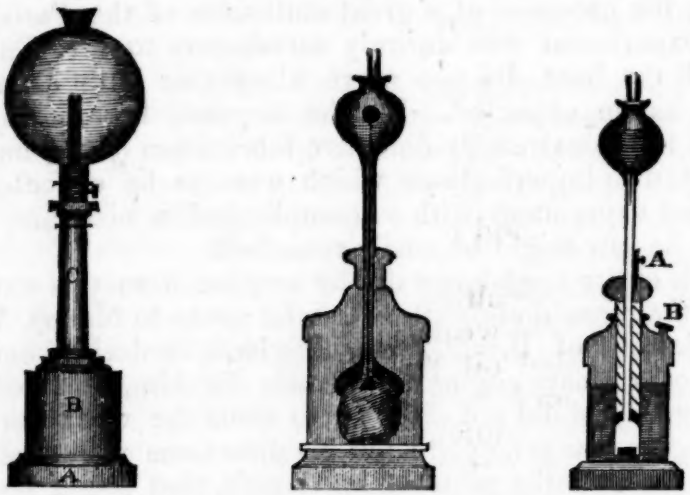
dent did the machinery very little injury; but they were obliged to build the boat almost entirely anew. She was completed in July; her length was sixty-six feet, and she was eight feet wide. Early in August, Mr. Fulton addressed a letter to the French National Institute, inviting them to witness a trial of his boat, which was made in their presence, and in the presence of a great multitude of the Parisians. The experiment was entirely satisfactory to Mr. Fulton, though the boat did not move altogether with as much speed as he expected. But he imputed her moving so slowly to the extremely defective fabrication of the machinery, and to imperfections which were to be expected in the first experiment with so complicated a machine, but which he saw might be easily remedied.

Such entire confidence did he acquire from this experiment, that immediately afterwards he wrote to Messrs. Watt and Bolton, of Birmingham, England, ordering certain parts of a steam-engine to be made for him, and sent to America. He did not disclose to them for what purpose the engine was intended; but his directions were such as would produce the parts of an engine, that might be put together within a compass suited for a boat. Mr. Livingston had written to his friends in this country, and through their interference, an act was passed by the legislature of the state of New York, on the 5th of April, 1803, by which the rights and exclusive privileges of navigating all the waters of that state, by vessels propelled by fire or steam, granted to Mr. Livingston by the act of 1798, which we have before mentioned, were extended to Mr. Livingston and Mr. Fulton, for the term of twenty years from the date of the new act. By this law, the time of producing proof of the practicability of propelling by steam a boat of twenty tons capacity, at the rate of four miles an hour, with and against the ordinary current of the Hudson, was extended two years, and by a subsequent law, the time was enlarged to 1807.

[For the Mechanic.]

HYDROSTATIC LAMPS.

Fig. 1. Fig. 2. Fig. 3.



In the winter of 1828-9, I tried a number of experiments, with a view to the invention of a lamp of simple construction, that should answer the purpose of a complicated and costly French clock-lamp which I had seen. Several of these lamps had been imported for our wealthy citizens, at about 75 or $150 a pair, and which, when out of order, it was difficult to get repaired.

They are ingeniously made to pump up the oil by clock-work, which is moved by a spring, from a reservoir in the foot of the lamp, to a small cistern in the upper part, which is furnished with a wick on the Argand principle. If the machine should pump up more oil than is wanted, the surplus runs down a small waste-pipe into the reservoir again. Fig. 1, represents a French clock-lamp, with the machinery enclosed in the lower part of the pedestal, marked A, and the oil in the part B. There are two tubes inside the pillar C, one to convey the oil to the cistern at top, and the other to carry down the surplus oil. The remaining parts, being like those of other lamps, need not be here described.

My first attempt was to make a lamp on the principle of the hydrostatic bellows, which is represented at Fig. 2. I procured a bladder of about three inches in diameter, and

capable of holding half a pint of oil. The neck of it I secured to one end of a small tube eighteen inches long, and to the other end of the tube, a glass lamp, having a hole through its bottom, was cemented. A lead weight, with a hole through it to receive the tube, and shaped to fit the upper part of the bladder, was so adjusted that its weight would press the oil from the bladder, just half way up the glass lamp. The bladder and weight were enclosed in a tin case which answered for a foot, and the tube would move freely up and down in the centre of the top of the case. The lamp, thus prepared, was lighted and placed on the mantle-piece, and after burning undisturbed for nine hours, the oil stood rather higher in the lamp than it did at first.

The only difficulties I experienced with this lamp were, that in very cold weather, the weight was not sufficient to raise the chilled oil through so small a tube, and, if the lamp was placed in a situation where it was subject to disturbance by violent shaking, like that of striking the table on which it stood, with the hand, or jumping on the floor, the oil would be put in motion, and raised higher in the lamp. But if winter oil be used in a moderately warm room, and the lamp is kept from violent shaking, these difficulties will not occur. The weight might be made considerably heavier, if a float were introduced into the lamp, having a wire attached to it, and passing down the tube to the bladder, with a conical termination. The float would rise with the oil in the lamp, and the cone would close the tube at bottom, and stop the passage of the oil, until the float was lowered again by the consumption of oil in the lamp.

This lamp will burn much longer than the common kind, on account of the greater quantity of oil in the reservoir; and will give a better light, because the oil can be kept always at the most suitable distance from the flame, by the adjustment of the weight. These are important points, and cannot fail to be appreciated by persons wanting a uniform light for a considerable length of time.

It has been frequently observed, that when a lamp is quite full of oil, it is very difficult to light, and is apt to smoke, in consequence of the wick being, as it were, inundated with oil, forming a large volume of flame, without sufficient oxygen to render the combustion complete, and therefore, affording but little light. On the

other hand, when the oil is too low in the lamp, the wick is burnt away, and the light soon goes out.

The lamp just described may be called self-acting, but I made several others, in which the oil was forced up by hand. One of the best of these, which has been in use in my family for about five years, and which I think is the best upon the whole, I will now describe. It is represented at Fig. 3, and consists of a glass lamp and tube passing into a case below, as in Fig. 2; but, instead of a bladder at the lower end of the tube, it is formed into a piston, and slides into a larger tube, which, with two valves, one at the bottom of the large tube below the piston, and the other at the bottom of the glass lamp, closing the end of the small tube, forms a complete pumping apparatus. The piston is depressed by the finger applied at A, and is raised by a spiral spring, which surrounds the small tube above the piston. The oil is put into the case at B in this lamp; but in the self-acting one, the oil is introduced at the top of the glass lamp; and in both, if the oil should by accident be forced over the top, it will pass into the case where the tube enters. PHILO.

[For the Mechanic.]

NEW ELECTRIC MACHINE.

When performing experiments in chemistry, or illustrating some of the principles of electricity, such small quantities of the electric fluid are often required, that it appears unnecessary to incur the expense of preparing a large machine for the purpose, and experimentalists generally resort to a glass tube, or the electrophorus. Both of these are inconvenient, on account of the difficulty of collecting the fluid from the excited surfaces. Thus when a glass tube has been rubbed with a piece of silk or fur, although electricity is produced upon its surface, yet it is not conducted by the glass, and to collect it, every part of the tube must be touched with a metallic conductor leading to the jar, or wherever we wish to collect it, otherwise, some portion will remain undisturbed. In regard to the electrophorus, those who are in the habit of using it are familiar enough with the trouble of exciting it, to render any improvement quite desirable.

We have lately seen a very neat and convenient apparatus, intended as a substitute for the above, and which is evidently calculated to obviate most of the difficulties experienced in their use. It is the invention of Mr. Charles G. Page, of Salem, and consists of a glass tube one and a half inches in diameter, and ten inches long. On the ends are brass caps, and upon the inside, a piston made of baked wood, and packed with soft elastic material, to allow it to yield to any inequality in the tube. It is also coated with amalgam to assist the operation. To the bottom of the piston, a small brass button, surrounded with points, is attached by a piece of glass rod about two inches in length. From this is suspended a chain long enough to reach the lower spherical cap, when the piston is at the top of the tube. The cap at top serves as a guide for the piston rod, and can be unscrewed when necessary.

With this description, the form, which is correctly delineated in the accompanying drawing, may be easily understood, and we will, therefore, proceed to explain the operation, which consists in simply moving the piston up and down in the tube, by which means the electric fluid is excited on the sides, from whence it is collected by the pointed button, and conducted by the chain to the bottom cap, which is the *prime conductor* of the machine. If a jar is to be charged, it may be presented to, or suspended from the small knob projecting from the bottom.

JUNIUS.

Boston, May 5th, 1834.

BORING CYLINDERS.

THE following brief accounts of the progress made in boring cylinders,—so important a feature in that branch of mechanical operation which relates to steam enginery,—we have extracted from that most admirably written, and comprehensive work, 'Historical and Descriptive Anecdotes of Steam Engines, and of their Inventors and Improvers, by Robert Stuart:' a work from which the dilettante in mechanical invention will draw a large fund of sound information; while the 'Operative' himself will have at his command a compendious body of reference to every valua-

ble improvement that has been achieved in this branch of science, viz. the application of a power, which next to that of the printing press, stands forth as the loftiest promontory in the chart of human invention.

'The increasing demand for the ponderous machinery of steam engines, having led capitalists to the erection of numerous founderies in different parts of the kingdom, their emulation was greatly instrumental in improving the art of casting and finishing cast iron ware. Carron, the first establishment in regard to magnitude, continued also to be the most celebrated for the general excellence of its productions; and it more especially enjoyed a great reputation for the truth with which its cylinders and pump barrels were bored and polished. The method usually followed was that employed from time immemorial for boring the wooden pipes or pump trees used to convey water. The pipe, placed in a carriage, was made to move forward as accurately as could be, in the direction of its axis, and to press against the face of the borer; this was a tool constructed of several cutters firmly fixed in a solid wheel, which was made to revolve by the power of horses or a waterfall; and as the cutter excavated the centre of the pipe, the frame moved forward so as to keep the tree pressed against the tool.

'But notwithstanding the proportions and modifications which Smeaton introduced into the boring-engine he designed for Carron, and which gave the superiority to the cylinders and pump-barrels fabricated in this foundery, over those sent from rival establishments, still the form of the cylinder, when drawn from the mould, influenced more or less that which it could receive from the action of the borer.

'Much of the advantage which now began to be experienced by engineers, from a greater attention paid to the mode of finishing pipes and cylinders, would have, in truth, been greatly circumscribed in their importance, but for an invention of Mr. John Wilkinson, the proprietor of iron works at Bersham, near Chester. In this beautiful contrivance, provided there was a sufficient thickness of metal, the want of truth in the casting of a hollow vessel was quite immaterial; for Wilkinson made his borer advance into the cylinder *along an inflexible rod*, which was fashioned with the greatest possible truth. So that the tool must excavate in a line as true as that which was

formed by the rod which guided it; and this, without question, was one of the most important improvements which had been introduced into the machinery for the manufacture of machines. Indeed, so universal was its application, that it may be considered as forming an era in their manufacture, as having laid the foundation of all the wonders which have since been achieved, in giving the utmost accuracy and beauty to implements and machines of every kind, and of every variety of construction.

'But in nothing was its importance more clearly seen, than in the fabrication of the parts of steam-engines. Cylinders of five and six feet in diameter, and piston rods of corresponding sizes, could be formed by its agency with the greatest truth, and as much precision as before its introduction it was possible to give to the small cylinders of air pumps.

'Watt speedily availed himself of his friend's improvement; and by having his rods and pumps properly bored and polished, he may be said now, for the first time, to have had it in his power to give comparative perfection to his own invention. For even the excellent workmanship of the Carron cylinders was so much surpassed by those made at Bersham, that when a new engine, on the condensing principle, was to be erected at Carron itself, Bolton writes to the chief of the establishment, that he must either change his mode of boring cylinders, or get one bored by Wilkinson, 'for he has,' says he, 'lately bored us some nearly without error; one which we have put up at Tipton, fifty inches in diameter, does not err the thickness of an old shilling in any part;' and in a letter from Watt to Smeaton, he says, 'so great has been the improvement made by Wilkinson, that he can promise upon a cylinder having a diameter of seventy-two inches, not being further distant from absolute truth in the worst part than a *thin* sixpence.' But even this deviation (about the fortieth of an inch) was greater than could be found in these ponderous vessels; for, from the admirable nature of the process, it was next to impossible that so great an error could be produced in a vessel, of however large dimensions.'—STUART ON STEAM ENGINES.

[For the Mechanic.]

MY NOTE BOOK.—NO. IV.

It is often necessary to consult old charters, deeds, wills and manuscripts written many centuries ago, either to settle some contested point in law, or to gratify curiosity. But as the writing is sometimes so much effaced as to be scarcely legible, a simple method of reviving it, will, we doubt not, be found useful.

To Revive old Writings.—Put three or four pounded nut-galls into about a wine-glass of spirit of wine; then heat the mixture, and expose the writing which you wish to revive, to the vapor. If old paper, and parchments, the writing of which can scarcely be read, be immersed in water containing a small portion of copperas dissolved, and then suffered to dry, the writing will re-appear with as much freshness as when new.

Red Ink.—Boil four ounces of Brazil-wood in a quart of water, for a quarter of an hour, and after adding a little alum, gum-arabic, and sugar-candy, allow it to boil 15 minutes longer. This ink may be preserved for a long time, and the older it grows, the redder it will become.

Blue Ink, may be made, by dissolving half an ounce of indigo, one dram of gum-arabic, and two drams of sugar, in half a pint of water.

Yellow Ink.—Use gamboge instead of indigo.

Green Ink, is made by boiling sap-green in water in which a little alum has been dissolved. More or less green can be added according to fancy.

To take Ink spots from Mahogany.—Apply muriatic acid with a rag, until the spot disappears; immediately wash with clean water.

To REMOVE A GOLD RING from the finger when it has become too tight, it is merely necessary to rub a little quicksilver upon it, which will soon penetrate it, and cause it to be so fragile, as to break without the least exertion.

BAD WATER may be corrected by adding five drops of sulphuric acid to a quart. After allowing it to stand for two hours, pour off about three parts for use; the rest throw away. JUNIUS.

Boston, May 5, 1834.

[For the Mechanic.]

PERPETUAL MOTION.

MUCH obliged to Junius, for his valuable article on this subject. So simple a *machine* we have not for a long time seen or heard of, for producing this desideratum. But we beg leave to state for the benefit of our readers, and perhaps, of Junius himself, that in the ancient astrological dialect, ☿ or mercury, signified quicksilver, which even yet retains the former title, and that ♃, or Jupiter, is tin. The trituration, or in plain English, grinding together of these metals, would, undoubtedly, produce an amalgam, but probably not much resembling *oyl olive.*

The moral, however, is a good one, which may be drawn from the perusal of this curious morsel of antiquity. We will not, however, explain it, fearing that those who are unable to decypher it, without aid, would never profit by the knowledge of it; and thus we should run the risk of casting pearls before swine. EUCLID MINOR.

Boston, May 1st, 1834.

COMMON SENSE.

'REFINED sense, and exalted sense, are not half so good as common sense,' says one author: common sense is the best sense in the world, says another. Follow its dictates, says my pen. It will serve better to keep you out of fire and water, and I may add, out of gaol, than the philosophy of a Newton, the genius of a Dryden, or the metaphysics of an

Edwards. Its seeds are sown in your mental garden, good reader; cultivate them by observation, reflection, and reading such authors, as have brought them to the greatest perfection. Its counsels will assist you in your domestic economy and every honest employment of life: but they will differ from the advice of the profession of counsellors in two respects; they will always be to your advantage, and cost you nothing. It will seldom address you in Greek or Latin, but in plain English.

Quit your pillow, and go about your business, if you have any, is its first injunction; if not, seek some. Let the sun's first beams shine on your head in the morning, and you shall not want a good hat to defend your head against his scorching rays at noon: earn your breakfast before you eat it, and the sheriff shall not deprive you of your supper. Pursue your calling with diligence, and your creditor shall not interrupt you. Be temperate, and the physician shall look in vain for your name on his day-book. If you have a small farm, or a trade, that will support your family, and add a hundred dollars a year to your capital, be contented, and never go abroad to buy land, that is to be made on the eighth day of the creation.

MISCELLANY.

Escutcheon Door Latch.—We would recommend to carpenters, builders, and others interested, to call at the Mechanics' Exchange and Reading Room in Wilson Lane, and examine a spring latch for doors, to be used instead of the common mortise latch. Having had some experience ourselves in these matters, we do not hesitate to state that most, if not all the difficulties which we have encountered in the mortise latch, appear, in the present contrivance, to be ingeniously obviated. The method of attaching it to the door, is more simple and expeditious than any other. Instead of weakening the still by a large mortise, it is merely necessary to bore a hole through the door with a centre bit, about one and a half inches diameter, and another about five eighths of an inch in diameter, for the bolt to pass through, and all the mortising to receive the latch is accomplished.

The improvements consist in making the *foller*, (or tumbler,) and spindle for the handles in one piece, supported on each side by large

brass or iron escutcheons, which cover the chamber made by the centre bit, to contain the working parts, and likewise prevent the disagreable shaking of the handles so often experienced in the common latch. These, together with the new, and effective form of the *foller*, the judicious application of the wire spiral spring, the introduction of tapered pins instead of screws for fastening on the handles, the firm method of attaching the escutcheons by two screws passing through the escutcheon on one side of the door, to the one on the other, which is tapped to receive them, constitute some of the advantages which the escutcheon latch possesses over others with which we are acquainted. The door can be securely fastened upon the inside by a slide on the escutcheon, which can be moved so as to prevent the action of the handles on the bolt.

They are manufactured by the patentees, Blake, Brothers, New Haven, Conn., who have deposited two as specimens, at the Mechanics' Reading Room, where they can be seen on application to the proprietor, Mr. Briggs, who, by the way, being determined to render his establishment as useful to Mechanics as possible, has requested us to state, that he will take charge of, and exhibit, any articles which manufacturers may wish to introduce to the notice of Mechanics.

Messrs. Brown & Peirce have, among a great variety of elegant and instructive articles, manufactured a set of apparatus calculated to explain the structure and operations of the eye. The demand from the public, in general, for scientific apparatus is a sufficient testimony of its utility; and with such views we should deem words spent in proof of this, as words spent in vain.

The apparatus above alluded to, consists of three distinct articles. The first is a complete model of an eye, with all its parts; showing the three coats or coverings, which are neatly turned wooden cases, the humors and lenses, of glass, the iris, and finally, the position of the optic nerve. The whole is so arranged that it can be taken apart and each part examined separately, at pleasure. The second piece of apparatus shows, by a similar contrivance, the process of seeing. By it, is shown the manner in which the rays fall on the optic nerve, so as to form the image of an object, the cause of persons being long and short-sighted, &c. The third is a representation of the muscles, or organs serving to move the eye. No motion of the human body is performed without the agency of a muscle; and there are six muscles whose sole office is to effect the various movements of the eye.

Both those who are acquainted with natural philosophy and those who are not, will, we presume, derive much pleasure as well as profit

from an examination of these articles. It is to be hoped, most devoutly, that so many men as there are, in our community, enjoying the privileges of sight, will no longer be content to remain ignorant of what kind of an instrument they make use of for this purpose.

Messrs. Editors :—In your last number, you gave a very learned and interesting account of the system of telegraphing, for communicating information, from a lecture delivered by John Pickering, Esq. of this city, with practical exemplifications, and an illustration of Mr. J. R. Parker's Semaphoric Telegraph as used in this city and harbor.

Permit me to enclose for insertion in your useful Repository, two notices of new inventions for similar operations; the one by musical sounds, to operate in thick weather, and in the night; the other, by subterraneous verbal communication; each embracing the useful principle of telegraphic operation. Yours, A Subscriber.

Musical Language.—An interesting report has just been made to the French Institute, respecting a system of musical language invented by *M. Sudre.* The committee appointed to inquire into the invention, state that it comprises the following advantages: 1st. That it furnishes a mode of communication capable of giving expression to all our ideas. 2d. That this new language admits of being rendered by sounds, characters, and gestures. 3d. That it may serve as a means of communication either near or at a distance. 4th. That it may be employed either for public or secret communications. 5th. That this system, however, is not susceptible, like the pronunciation of speaking languages, of being successively changed, but that it is in its nature unalterable. Among the members of the committee who have made this favorable report of the invention, are Messrs. Cherubini, Boieldieu, and Auber.

Machine for Subterraneous Correspondence.—M. M. Jobard and Stieldorff have recently obtained from the Belgian government a patent for a newly invented instrument, called the Logophore, by means of which it is said that verbal correspondence may be carried on from one place to another, however distant. A practical application of this ingenious invention is to be immediately made between Brussels and Antwerp, by means of subterraneous pipes, which will transmit words uttered by voices from place to place at intervals of two miles. Thus, in less than a quarter of an hour a question may be asked and answered between the Royal Palace at Brussels and the Castle at Lacken. The expense will not exceed fifteen or twenty thousand francs.

THE MECHANIC.—If there is any situation truly enviable, it is that of an industrious mechanic, who, by his own unaided exertion, has established for himself a respectable place in society; who, commencing in poverty, by his skill and perseverance overcomes every obstacle, vanquishes every prejudice, and builds up for himself a reputation whose value is enhanced for others. And let it be remembered that this situation is attainable by all who have health and practical knowledge of their business. Industry and virtuous ambition are seldom exerted in vain.

PRESERVE YOUR VESSELS.—A gentleman who has tried the experiment, recommends to all ship-builders, to put between the ceiling and plank, pulverised *charcoal*, which is a much better preservative than salt—is much lighter, and prevents the dry rot, absorbing, as the charcoal does, all the acidity of the wood. The same article is also very useful in preserving meats, fruits, &c. which, by its astonishing quality may be sent to any part of the world, without injury. Try it, and be convinced.

CURIOUS CLOCK.—The most curious thing in the cathedral of Lubeck is a clock, of very singular construction, and very high antiquity. It is calculated to answer astronomical purposes, representing the places of the sun and moon in the ecliptic, and many other contrivances. The clock, as an inscription sets forth, was placed in the church upon Candlemas day, in 1405. Over the face of it appears an image of our Saviour, and on either side of the image are folding doors, so constructed as to fly open every day when the clock strikes twelve. At this hour, a set of figures representing the twelve apostles come out from the door on the left hand of the image, and pass by in review before it, each figure making its obeisance by bowing as it passes that of our Saviour, and afterwards entering the doors on the right hand. When the procession terminates the door closes.

CLOVES.—The tree which produces this well known spice is a native of the East Indies, and in its general appearance resembles the laurel; the parts used are the unexpanded flowers, which acquire their dark brown color from the smoke in which they are dried, in order to preserve their aromatic qualities.

ANSWER.

MESSRS. EDITORS:—So long ago as last November, I noticed a question in the Mechanic, respecting a triangular piece of land, &c. If the author will admit that the triangle is right angled, and also isosceles, which I suppose is his intention, my solution is as follows. In the first place I suppose the field to be a square which shall contain six acres or 960 rods. The square root of 960 is 30·983, which is the side of the square ABCD. Consequently, it is the side DC or BC of the triangle BDC, which contains half of the 6 acres, or three acres. We are now told, that after cutting off a certain number of rods from each side of this triangle, BDC, the mower had taken just one half the grass, that is, there was the triangle EFG left, which contained half as much as the triangle BDC; it remains now to find the side EF or FG of the triangle EFG. By Euclid, the areas of similar triangles are to each other as the squares of their homologous sides; that is, the triangle BDC, is to the triangle, EFG, as $\overline{BC}^2$ or $\overline{DC}^2$ is to $\overline{EF}^2$ or $\overline{GF}^2$.

Hence $480 : 240 :: \overline{30{\cdot}983}^2$ &c. $= 960 : x^2$. Multiplying the extremes and means, we have $480\,x^2 = 230400$.

Dividing by 480; $x^2 = 480$

and $x = \sqrt{480} = 21{\cdot}908$.

Hence the side of the triangle, EFG, after the two rods are cut off from the triangle BDC, is 21·908, &c. rods. E. G.

TO CORRESPONDENTS.

WE have received a communication from Prelude, and several questions and answers from various sources, besides articles that have been some time on hand, and we shall dispose of them as soon as circumstances will permit.